

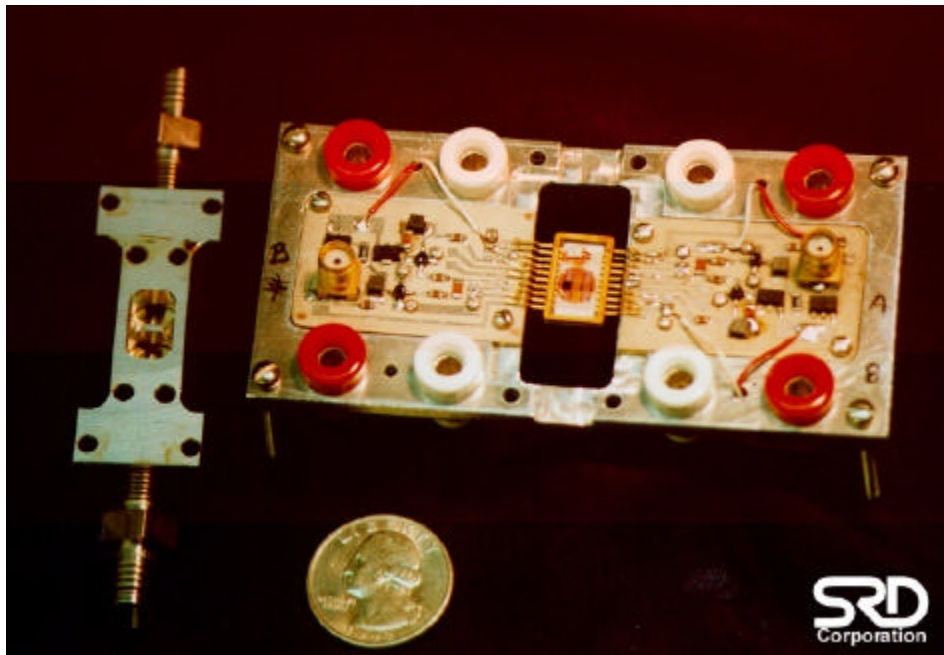


Surface Acoustic Wave Mercury Vapor Sensor



Developer: Sensor Research and Development Corporation
Contract Number: DE-AR26-97FT34316
Crosscutting Area: CMST

**Mixed Waste
FOCUS AREA**



Problem:

The US Department of Energy (DOE) is developing thermal processes for treating hazardous mixed wastes generated from decades of nuclear weapons production and other treatment processes for wastes. These thermal treatment systems contribute to atmospheric mercury emissions. Of all the trace metals contained in these emissions, mercury is of the greatest concern since it is highly mobile, very toxic, and the most volatile of the metals. It has long-term persistence in the environment

and can bioaccumulate within the food chain and lead to irreversible neurological disorders and other health related problems.

Continuous Emissions Monitors (CEMs) for mercury will be required to demonstrate the effectiveness of mercury control methods, such as mercury filters, and to enable the real-time process control of these thermal treatment systems. Monitoring of mercury in off gases is a crucial need that will facilitate the licensing and permitting of mixed waste treatment systems.

Solution:

Sensor Research and Development Corporation (SRD) is developing a fast, inexpensive, reliable, and very sensitive in situ sensor instrument for detecting and monitoring vaporized mercury. This sensor will be capable of detecting extremely low (< 200 ppb) levels of mercury vapor, will be field deployable, and will provide continuous data on either cumulative mercury exposure or instantaneous concentration.

Benefits:

- ▶ Substantial net cost advantage over competing technologies (estimated at $< \$2,000/\text{unit}$)
- ▶ Predictable, reliable performance with little or no maintenance requirements when deployed
- ▶ Highly sensitive to mercury vapor over a broad range of concentrations (Estimated dynamic range from less than 0.1 parts-per-billion (ppb) to greater than 100 ppm)
- ▶ Simple, rugged design with low power requirement, portability and in situ operation



►Adaptable as either CEM, process control instrument, fixed remote site monitor, or portable site characterization instrument

►Safe and nonpolluting

Technology:

SRD's prototype instrument utilizes a surface acoustic wave (SAW) microsensor which employs a gold film as a sensing element to detect mercury vapor. The careful integration of chemiresistive and SAW technology has the potential to provide a small, low-power, portable, inexpensive and accurate means of monitoring mercury vapor over a wide concentration range (sub-ppb to ppm levels). The selectivity of the sensor is embodied in the gold film while the sensitivity is in the SAW device.

Upon exposure to mercury vapor, the film conductivity (resistivity) and mass change as a function of mercury concentration. The SAW device monitors the film changes and outputs a frequency which is a direct measure of the mercury concentration.

Through the development of other selective films, this sensor technology is extendible to the selective detection of other metal

contaminants (e.g. Mercury (Hg), Cadmium (Cd), Uranium (U)), gaseous pollutants such as H₂S, NO_x, SO_x and NH₃, and volatile organic compounds (VOC's) which are extremely important because they have all been associated with a host of harmful medical and biological problems in humans, animals and plants.

Contacts:

SRD is a small business located in the greater Bangor area whose goal is to develop and market novel chemical and physical sensors for process control, emissions monitoring, corrosion detection and environmental testing. For more information regarding this project, the contractor contact is:

Principal Investigator:
Mr. Joshua J. Caron
Sensor Research and Development Corporation
5 Godfrey Drive
Orona, ME 04473
Phone: (207) 866-0100
Fax: (207) 866-2055
E- mail: jcaron@srdcorp.com

DOE's Federal Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new

technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

DOE Project Manager:
Mr. Ronald K. Staubly
Federal Energy Technology Center
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
Phone: (304) 285-4991
Fax: (304) 285-4403
E-mail: rstaub@fetc.doe.gov

